

REMARKS

Applicants request favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

Claims 1-12 are presented for consideration. Claims 1 and 11 are independent. Claims 1 and 11 have been amended to clarify features of the subject invention. Support for these changes can be in the original application, as filed. Accordingly, no new matter has been added.

Applicants request favorable reconsideration and withdrawal of the rejections set forth in the above-noted Office Action.

Claims 1, 3, 4, and 10-12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,854,490 to Ooaeh et al. in view of U.S. Patent No. 4,467,205 to Beisswenger et al. Claim 2 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the Ooaeh et al. patent in view of the Beisswenger et al. patent as applied above to claims 1, 3, 4, and 10-12, and further in view of U.S. Patent No. 4,199,689 to Takigawa. Claims 5 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Ooaeh et al. patent in view of the Beisswenger et al. patent as applied above to claims 1, 3, 4, and 10-12, and further in view of U.S. Patent No. 5,136,171 to Leung et al. Claims 7-9 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Ooaeh et al. patent in view of the Beisswenger et al. patent as applied above to claims 1, 3, 4 and 10-12, and further in view of U.S. patent application publication number 2003/0189180 A1 to Hamaguchi et al. Applicants submit that the cited art, whether taken individually or in combination, does not teach many features of the present invention, as previously recited in claims 1-12. Therefore, these rejections are respectfully

traversed. Nevertheless, Applicants submit that independent claims 1 and 11, as presented, amplify the distinctions between the present invention and the cited art.

In one aspect of the present invention, independent claim 1 recites an electron gun including a cathode portion which emits electrons, an anode portion which has an aperture and accelerates the emission electrons, a bias portion which is arranged between the cathode portion and the anode portion and controls trajectories of the emission electrons, a shielding portion which is arranged below the anode portion and shields some of the emission electrons so as to form a crossover between the bias position and the anode portion, and a cooling portion which is arranged at the shielding portion for cooling the shielding portion. The shielding portion includes a tilt portion tilting with respect to an incident direction of the emission electrons becoming incident on the shielding portion, and includes a closing portion located between the tilt portion and the anode portion. The closing portion inhibits the electrons reflected by the tilt portion from passing through the aperture of the anode portion.

In another aspect of the present invention, independent claim 11 recites an electron beam exposure apparatus including an electron gun including a cathode portion which emits electrons, an anode portion which has an aperture and accelerates the emission electrons, a bias portion which is arranged between the cathode portion and the anode portion and controls trajectories of the emission electrons so as to form a crossover between the bias portion and the anode portion, a shielding portion which is arranged below the anode portion and shields some of the emission electrons, and a cooling portion which is arranged at the shielding portion for cooling the shielding portion. The electron beam exposure apparatus further includes a stage which moves in

holding a substrate to be exposed by using the emission electrons. The shielding portion includes a tilt portion tilting with respect to an incident direction of the emission electrons becoming incident on the shielding portion, and includes a closing portion located between the tilt portion and the anode portion. The closing portion inhibits the electrons reflected by the tilt portion from passing through the aperture of the anode portion.

Applicants submit that the cited art, whether taken individually or in combination, does not teach or suggest such features of Applicants' present invention, as recited in independent claims 1 and 11.

The Ooaeh et al. patent shows a charged particle beam exposure device in which an electron gun emits an electron beam traveling along a beam axis. The electron gun has a cathode having a tip, the tip having substantially a circular conic shape and a tip surface substantially at the beam axis. A first voltage is applied to the cathode. An anode has a first aperture substantially on the beam axis to which a second voltage higher than the first voltage is applied. A control electrode has a second aperture substantially on the beam axis and a voltage lower than the first voltage is applied to the control electrode to control a current of the cathode. The second aperture is larger than the tip surface. A guide electrode having a third aperture substantially on the beam axis is arranged between the cathode and the anode, and a voltage higher than the first voltage and lower than the second voltage is applied to the guide electrode. The third aperture is smaller than the tip surface. A lens electrode with a fourth aperture substantially on the beam axis is arranged between the guide electrode and the anode. A voltage lower than the first

voltage is applied to the lens electrode to form a cross-over image of the electron beam. The fourth aperture is larger than the third aperture.

In more detail, the Ooach et al. patent shows a beam-cutting-off aperture (metal electrode) 411 having a cooling mechanism 430 in order to stabilize temperature. A guide electrode 48 of an electron gun 10, as shown in Figure 7, may be considered to correspond to the shielding portion of the present invention. Applicants submit, however, that the Ooach et al. patent does not teach or suggest anything regarding cooling of the guide electrode 48. Accordingly, the electrode 48 in the Ooach et al. patent is easily heated. Applicants submit, therefore, that the Ooach et al. patent does not teach or suggest at least the arrangement of the bias portion, the shielding portion, and the cooling portion of the present invention, as recited in independent claims 1 and 11.

Applicants further submit that the remaining art cited fails to cure the deficiencies noted above with respect to the Ooach et al. patent.

The Beisswenger et al. patent shows a restrictor M (anode electrode) having a tilt portion. The anode electrode may be considered to correspond to the shielding portion of the present invention. In the Beisswenger et al. patent, a high electrical field is impressed to the anode electrode so the scattering electrons and secondary electrons are generated in the high electrical field and causes weak discharge. In contrast to the device in the Beisswenger et al. patent, in the present invention, the shielding portion is arranged outside the cathode and the bias electrodes, and below the anode electrode outside the high electrical field, so that generation of electrons discharged by the high voltage can be reduced. Accordingly, Applicants submit that the

arrangement in the Beisswenger et al. patent does not solve the problems of weak discharge, which the present invention overcomes. Applicants further submit that the Beisswenger et al. patent teaches nothing regarding cooling of the shielding portion in the manner of the present invention recited in independent claims 1 and 11.

The Examiner relies on the Takigawa patent for teaching an electron gun with a highly controllable diameter at a beam cross-over point, which is formed using a cathode (emitter) having a hemispherical (that is, rounded) top surface. The Examiner relies on the Leung et al. patent for teaching that when a cooling portion is used with a Faraday cage (210) to measure the current of an electron beam, it must include an insulator and de-ionized water, which should be passed through the cooling portion. The Examiner relies on the Hamaguchi et al. publication for teaching that a plurality of electron guns can be provided in a single chamber, and that additional electrodes (slit-deflecting unit 15) to which voltages are applied can be provided between the anode and the fielding portions (slit covers 11).

Applicants submit, however, that these remaining citations, as with the Ooach et al. patent and Beisswenger et al. patent, do not teach or suggest salient features of Applicants' present invention, as recited in independent claims 1 and 11, which have been discussed above. Namely, that art, even if combined in the manner suggested in the Office Action, does not teach or suggest the arrangement of the bias portion, the shielding portion and the cooling portion of the present invention, as recited in those claims. Accordingly, the remaining art cited adds nothing to the teachings of the Ooach et al. patent and the Beisswenger et al. patent that would render obvious Applicants' present invention, as recited in independent claims 1 and 11.

For the foregoing reasons, Applicants submit that the present invention, as recited in independent claims 1 and 11, is patentably defined over the cited art, whether that art is taken individually or in combination.

Dependent claims 2-10 and 12 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicants submit that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the rejections set forth in the above-noted Office Action and an early Notice of Allowance are also requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our address given below.

Respectfully submitted,

A handwritten signature in dark ink, appearing to read "Steven E. Warner", is written over a horizontal line.

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